

Amendments to the Claims:

This listing of the claims will replace all prior versions, and listings, of the claims in the application:

1 1. (Currently Amended) A method ~~for~~of detecting an incident ~~incidents~~ along a roadway,
2 comprising the unordered steps of:
3 arranging a plurality of readers at intervals along a roadway for reading uniquely
4 identified data from each one of a plurality of vehicles;
5 correlating the data with previously read data to obtain information ~~on~~regarding each one
6 of the plurality of vehicles;
7 determining the number of vehicles potentially affected by ~~incidents~~the incident along the
8 roadway; and
9 comparing the number of vehicles potentially affected by the incident ~~incidents~~ to a
10 sample threshold.

1 2. (Original) The method of claim 1, wherein the plurality of readers comprises a plurality of
2 traffic probe readers.

1 3. (Currently Amended) The method of claim 1, wherein each one of the plurality of readers is
2 spaced at least five kilometers from an adjacent reader.

1 4. (Currently Amended) The method of claim 1, wherein the information regarding each one of
2 the plurality of vehicles comprises ~~is~~ at least one of:
3 a vehicle speed;
4 an expected vehicle travel time for a vehicle to travel between two adjacent readers;
5 ~~and/or~~
6 an expected arrival time ~~of each of the plurality of vehicles~~ for a vehicle to arrive at one of
7 the plurality of readers.

1 5. (Currently Amended) The method of claim 1, wherein the step of determining the number of
2 vehicles potentially affected by ~~the~~an incident ~~further~~ comprises the step of determining ~~the~~an
3 expected arrival time for each one of the plurality of vehicles to be detected by a particular one
4 of the plurality of readers.

1 6. (Currently Amended) The method of claim 5, wherein the step of determining the number of
2 vehicles potentially affected by ~~the~~an incident further comprises the steps of:
3 determining ~~the~~an amount of time each one of the plurality of vehicles ~~vehicle time~~ is
4 overdue past the expected ~~detection~~arrival time; and
5 comparing ~~an~~the amount of time each one of the plurality of vehicles ~~vehicle time~~ is
6 overdue to a predetermined threshold.

1 7. (Original) The method of claim 6, wherein the predetermined threshold is adjusted according
2 to the roadway usage.

1 8. (Currently Amended) The method of claim 5, wherein the step of determining the number of
2 each one of the plurality of vehicles potentially affected by ~~the~~an incident further comprises the
3 steps of:
4 determining ~~the~~an amount of time each one of the plurality of vehicles ~~vehicle time~~
5 is ~~arrives~~ earlier than the expected ~~detection~~arrival time; and
6 comparing ~~an~~the amount of time each one of the plurality of vehicles ~~vehicle time~~ arrived
7 arrives early to a predetermined threshold.

1 9. (Original) The method of claim 8, wherein the predetermined threshold is adjusted according
2 to the roadway usage.

1 10. (Currently Amended) The method of claim 1, further comprising detecting an incident in
2 response to the number of ~~each of the plurality of vehicles~~ potentially affected by ~~the~~an incident
3 exceeding the ~~predetermined~~ sample threshold.

1 11. (Currently Amended) The method of claim 10, wherein ~~each~~ some of the number of
2 ~~plurality of vehicles~~ potentially affected by ~~the~~ an incident ~~are~~ is overdue at a particular one of the
3 plurality of readers.

1 12. (Currently Amended) The method of claim 10, wherein ~~each~~ some of the number of
2 ~~plurality of vehicles~~ potentially affected by ~~the~~ an incident ~~has arrived~~ arrive early at a particular
3 one of the plurality of readers.

1 13. (Currently Amended) The method of claim ~~10~~ 12, wherein the number of ~~each of the~~
2 ~~plurality of vehicles~~ potentially affected by ~~the~~ an incident is counted over a predetermined time
3 interval.

1 14. (Currently Amended) The method of claim 4, wherein the expected arrival time of ~~expected~~
2 ~~readings~~ is a function of ~~the~~ a vehicle type.

1 15. (Currently Amended) The method of claim 1, wherein the plurality of readers ~~comprises~~
2 comprise respective a transponder reader ~~readers~~.

1 16. (Currently Amended) The method of claim 1, wherein the plurality of readers ~~comprises~~
2 comprise respective a license plate reader ~~readers~~.

1 17. (Currently Amended) The method of claim 1, wherein the determining the number of
2 vehicles potentially affected by the incident comprises determining an instantaneous speed of
3 ~~each~~ some of the plurality of vehicles ~~is determined by a Toll Gateway sensor~~.

1 18. (Currently Amended) The method of claim ~~5~~ 6, wherein the expected arrival time for each
2 one of the plurality of vehicles ~~to be detected by reader~~ is calculated by:

$$ExpSpeed[V_i, S_j] = \min(StartSpeed[V_i, S_j], HighSpeed[S_j])$$

$$ExpTime[V_i, S_j] = \frac{Length[S_j]}{ExpSpeed[V_i, S_j]}$$

where,

V_i is a vehicle entering a ~~road~~ roadway segment S_j ;

$ExpTime[V_i, S_j]$ = expected arrival time for the vehicle V_i ~~to be detected~~;

$StartSpeed[V_i, S_j]$ = starting speed of the vehicle V_i at the beginning of the roadway segment S_j ;

$ExpSpeed[V_i, S_j]$ = expected speed of the vehicle V_i over the roadway segment S_j ;

$HighSpeed[S_j]$ = average legal speed limit over the roadway segment ~~starting at~~ S_j ; and

$Length[S_j]$ = length of the roadway segment ~~starting at~~ S_j .

19. (Currently Amended) The method of claim 18, wherein an overdue time for each one of the plurality of vehicles ~~that has not been detected by the expected reader within the expected time~~, is calculated by:

$$Overdue[V_i, S_j, t_c] = \frac{t_c - StartTime[V_i, S_j] - ExpTime[V_i, S_j]}{ExpTime[V_i, S_j]} \times 100\%$$

where,

$StartTime[V_i, S_j]$ = time that the vehicle V_i entered the roadway segment ~~starting at~~ S_j .

20. (Currently Amended) The method of claim 18, wherein a difference between the expected arrival time and an actual link segment travel time for each one of the plurality of vehicles is calculated by:

$$Diff[V_i, S_j] = \frac{\max\left(ActualTime[V_i, S_j], \frac{Length[S_j]}{HighSpeed[S_j]}\right) - ExpTime[V_i, S_j]}{ExpTime[V_i, S_j]} \times 100\%;$$

where:

$ActualTime[V_i, S_j]$ = actual segment travel time for the vehicle V_i to travel over the roadway segment S_j .

21. (Currently Amended) The method of claim 18, wherein the starting speed of the vehicle V_i at the beginning of the roadway segment S_j is calculated by: $StartSpeed[V_j, S_j]$ = average speed of the vehicle V_i over a prior roadway segment.

22. (Currently Amended) The method of claim 18, wherein the starting speed of the vehicle V_i at the beginning of the roadway segment S_j is calculated by: $StartSpeed[V_j, S_j]$ = instantaneous speed of the vehicle V_i at the start-beginning of the roadway segment of S_j , measured by a toll gateway speed sensor.

23. (Cancelled)

24. (Currently Amended) The method of claim 1, further comprising the step of excluding each a vehicle, that which is overdue for by more than a predetermined time cutoff threshold measured from a the time that the vehicle is initially overdue, from being ~~counted~~ included in the number of ~~each of the plurality of vehicles~~ potentially affected by ~~incidents~~ the incident.

25. (Currently Amended) The method of claim 1, further comprising the step of excluding each a vehicle, that which has arrived early at the end of a roadway segment for by more than a predetermined time cutoff threshold measured from ~~the~~ a time that the vehicle is initially early, from being ~~counted~~ included in the number of ~~each of the plurality of vehicles~~ potentially affected by ~~the incident~~ incidents.

26. (Currently Amended) The method of claim 1, further comprising the step of suppressing the detection of ~~the an incident in a~~ along the roadway segment ~~when~~ where the number of vehicles exiting ~~the a segment of the roadway on an off-ramp over a predetermined interval of time~~ exceeds a predetermined threshold.

27. (Currently Amended) A method for detecting ~~an incidents~~ incident along a roadway, comprising the unordered steps of:

3 arranging a plurality of traffic probe readers at intervals along thea roadway for reading a
4 respective transponder disposed on each one of a plurality of vehiclesa vehicle;

5 correlating ~~the~~ transponder readings from each one of the plurality of vehicles ~~and with~~
6 expected readings from associated with each one of the plurality of -vehicles at more than one
7 traffic probe reader to obtain at least one of a count of overdue vehicles or a count of early
8 arriving vehicles; and

9 detecting the incident, incidents which result results in an interruption to the flow of
10 traffic, in accordance with the correlating.

1 28. (Currently Amended) The method of claim 27, further comprising the step of writing time
2 and location data into the transponder of each one of the plurality of vehicles.

1 29. (Currently Amended) The method of claim 27, further comprising the step of arranging a
2 plurality of toll gateways at intervals along a roadway for reading a respective transponder ID
3 from a respective transponder disposed on each one of thea plurality of vehicles and for
4 determining the presence of vehicles not having a transponder-ID.

1 30. (Currently Amended) An incident detection system comprising:

2 a traffic management center processor connected to a data network;

3 a plurality of unique vehicle data readers connected to said data network such that
4 uniquely identified data are read from each one of a plurality of vehicles;

5 a correlation processor, wherein said uniquely identified data are correlated to obtain at
6 least one of a count of overdue vehicles and-or a count of early arriving vehicles; and

7 an incident detection processor coupled to the correlation processor and adapted to
8 compare at least one of the count of overdue vehicles to a first sample threshold orand the count
9 of early arriving vehicles to a second sample threshold.

1 31. (Currently Amended) The system of claim 30 wherein said plurality of unique vehicle data
2 readers ~~further comprise~~ at least one of:

3 a plurality of traffic probe readers, each one of said plurality of traffic probe readers
4 having ~~an automatic~~ a unique vehicle identification reader; ~~and~~
5 a plurality of toll gateways, each one of said plurality of toll gateways having an
6 ~~automatic~~ a unique vehicle identification reader.

1 32. (Currently Amended) The system of claim ~~31~~ 30 further comprising a plurality of roadside
2 toll collection devices coupled to said plurality of toll gateways, coupled to said plurality of
3 traffic probe readers, and coupled to said traffic management center, such that ~~the~~ a volume of
4 data transmitted to said traffic management center is ~~minimized~~ reduced.

1 33. (Original) The system of claim 30 wherein said correlation processor is connected to said
2 traffic management center processor.

1 34. (Currently Amended) The system of claim 30 wherein said correlation processor is
2 connected to said plurality of unique vehicle data readers ~~roadside toll collection device~~.

1 35. (Original) The system of claim 30 wherein said incident processor is connected to said
2 traffic management center processor.

1 36. (Currently Amended) The system of claim 30 wherein said incident processor is connected
2 to said plurality of unique vehicle data readers ~~roadside toll collection device~~.

1 37. (New) The apparatus of claim 30, wherein said incident detection processor is further
2 adapted to determine an amount of time each one of the overdue vehicles is overdue past an
3 expected arrival time, and to compare the amount of time each one of the overdue vehicles is
4 overdue to a predetermined threshold.

1 38. (New) The apparatus of claim 30, wherein said incident detection processor is further
2 adapted to determine the amount of time each one of the early arriving vehicles is early with

- 3 respect to an expected arrival time, and to compare the amount of time each one of the early
- 4 arriving vehicles is early to a predetermined threshold.